Universidad Complutense de Madrid
Facultad de CC. Económicas y Empresariales

Master Universitario en

FINANZAS DE EMPRESA

Trabajo Fin de Máster

TITULO DEL TRABAJO

VENTURE CAPITAL AND VALUE ADDED: IMPACT OF DISTANCE ON PERFORMANCE

Autor: Gerardo Raúl Trucci Bruschi

Tutor: José Martí Pellón

V. bº del tutor:

Firma y fecha

Año 2020

VENTURE CAPITAL AND VALUE ADDED: IMPACT OF DISTANCE ON PERFORMANCE

Gerardo Trucci

Tutor: José Martí

Keywords: Venture capital, small and medium enterprises, financial and non-financial resources, value added, monitoring costs, growth, performance, distance, geographic proximity

JEL classification: G14, G24, L20, L26

ABSTRACT

Research found that venture capital financing has a positive effect on firms' growth. Part of this positive impact is explained by the value added, i.e., monitoring and strategic advice, provided by venture capital entities (VCEs, hereafter) to their portfolio companies. Literature found that spatial proximity between VCE and invested firms facilitates the interchange of information, and thus the execution of value added activities provided by VCEs. In this work, we investigated whether geographical distance, measured in both kilometers and travel time between portfolio companies and their lead investor, affects performance. We base our analysis on a sample of 1035 firms observed between 1996 and 2018. The results of our difference-in-differences econometric estimation indicate that distance matters for companies invested by private venture capital entities: on average, firms that are closer to their lead investor present a higher growth in terms of assets when compared to the most distant ones.

1. INTRODUCTION

Literature shows that venture capital entities (VCEs, hereafter) involvement has a positive impact on investees' growth, in terms of employment and sales growth (Bertoni et al., 2011), productivity (Alemany and Martí, 2007), and efficiency (Chemmanur et al., 2011). This positive effect derives from a screening process, i.e., a meticulous selection process before investment (Amit et al., 1998), and both the financial and the non-financial aid provided by VCEs. The non-financial aid, i.e., value added, consists of constant monitoring and strategic advice (Macmillan et al., 1989).

Chemmanur et al. (2011) and Croce et al. (2013) find evidence of the positive effect of non-financial value added on firm performance. In this regard, the more frequent the interaction between investors and investees, the greater the value added provided by VCEs (Sapienza, 1992). According to Sorenson and Stuart (2001), spatial proximity between the VCEs and invested firms facilitates the interchange of information and monitoring and value added activities. Hence, the distance between VCEs and their portfolio companies may have a negative impact on performance.

The purpose of this work is to investigate whether geographical distance, measured in both kilometers and travel time between portfolio companies and their lead VCEs, affects performance, represented by the gross revenues and total assets of invested firms over time.

We focus on a large sample of Spanish venture-backed firms financed between 2005 and 2012. We compared firm performance in the closest versus the most distant firms using a difference-in-differences (DD) methodology with fixed effects.

The rest of the manuscript is structures as follows. In section 2, we outline the theoretical background and develop our hypotheses. In section 3, we describe the data and the methodology. In section 4, we show the empirical results. In section 5, we include the discussion and highlight our conclusions.

2. THEORETICAL BACKGROUND

2.1. Information asymmetries and venture capital

According to Akerlof (1970), a market with uncertainty and the existence of goods of many quality ranges imposes an obstacle to the sound functioning of markets, featuring a scenario in which different agents having different amounts of information try to take advantage of each other. This situation occurs because the distribution of information is imperfect within society, i.e. asymmetrical. This derives in the materialization of transaction costs and, ultimately, in agency costs, which consist in any effort or inefficiencies incurred when preventing any possible conflict of interests between two parties.

This context of asymmetrical information creates a favorable environment for adverse selection within financial markets. The managers of a company naturally have more information about it, and their ability to interpret such material is higher than that of third parties, since they have an inside perspective of the business. Managers may have incentives to not share full information with others, who could become potential investors. Also, as sometimes managers may try to transmit a better picture than reality as an artifice to mislead the decisions of potential investors, there is a cost in verifying the information (Myers and Majluf, 1984; Stein, 2003).

Small and medium size enterprises (SMEs, hereafter) are highly affected by information asymmetries, suffering from adverse selection and moral hazard problems, and thus tend to have difficult access to external financial sources. This situation may undermine their growth prospects and their future performance (Carpenter and Petersen, 2002). Therefore, normally the financing of firms at this stage is bounded by their internally generated cash flows (Bertoni et al., 2013).

These financial restrictions to SMEs may have an important impact on the economy. SMEs play an important role concerning job creation, economic growth, and economic structural change, functioning as the innovation system that leads to structural change (Robu, 2013). As Robu (2013) points out, SMEs are considered as the backbone of any economy, since, according to OECD, they “represent more than 95% of enterprises and ensure 60-70% of the jobs” (Robu 2013, p. 86). Due to their flexibility, disruptiveness, innovativeness, and competitiveness, SMEs represent a dynamism agent

to the economy, improving productivity and promoting competitiveness within markets. As Robu (2013) indicates, regardless of the social and economic standards of a country, SMEs stand as the biggest contributors to the gross domestic product and employment creation.

Fortunately, VCEs are specialized in dealing with SMEs' financing problems. VCEs are not ordinary investors. Instead, they have very specific skills that qualify them to cope with agency costs and asymmetrical information better than other financial intermediaries. VCEs reduce information asymmetries by performing a detailed screening process, followed by tailor-made contracts and strict monitoring procedures (Amit et al., 1998; Weiss, 1991). Moreover, VCEs do not condition their investment to the possession of high collaterals, which is convenient for the new entrepreneurial businesses that do not have much to offer in this aspect. The main goal of entities that operate in the venture capital industry is to build a portfolio of promising innovative companies, normally at initial stages of development. In addition to funding, they also provide valuable non-financial services to portfolio companies.

Regarding screening, since venture managers are specialized agents that look for promising entrepreneurial companies to invest in, they could be credited for being able to pick the winners. Consequently, the better performance of invested firms could be explained by this assumption. However, Croce et al. (2013) studied the impact of screening and value added services on the better performance of VC backed high tech firms in Europe. In their work, they measure separately the impact of screening and value added services on the productivity of VC invested firms, and suggest that the value added provided by their mentors has an important impact on performance, beyond that of screening.

The existence of investors specialized in supporting innovative companies has a positive effect on the economy. There is a significant positive causal relationship between the presence of venture capital investment and employment growth and job creation (Belke et al., 2003). Hence, they conclude that governments should facilitate the establishment of an institutional environment friendly to the flourishing of a healthy venture capital industry so that it can spur a virtuous cycle of entrepreneurial dynamism, innovation, and job creation. Croce et al. (2019) also provide evidence that supports

such a view. They compare the performance of both private and government-owned venture capital entities on job creation during an economic crisis and under normal economic conditions. They find that private venture capital backed firms during periods of crisis do better (in terms of growth) than those backed by government entities, probably due to the broader (political) independence private entities have to perform their activity – like screening, monitoring, and value added services – in such distressing times compared to government-managed entities. During normal economic conditions, however, they found that the investments of government-owned venture capital entities have a higher impact on employment growth. They claim this is probably due to the tendency of government-led investments to prioritize labor-intensive industries. Anyhow, as seen, it is suggested that VC activity has an overall positive effect on employment growth.

2.2.The role of financial resources provided by VCEs

The financial aid provided by VCEs, solely considered, has an important impact on the growth prospects of SMEs (Bertoni et al., 2011). This funding plays a crucial role in relieving the financial restrictions of SMEs, enabling them to undertake their investment projects. Bertoni et al. (2013) found that, after receiving VC funding, the investment dependency of SMEs on internally generated cash flows experiences a significant reduction. In that the same vein, Bertoni et al. (2010) find that the financial constraints of new-technology-based firms backed by independent VCEs disappear after funding. Firms that have limited access to external finance present a slightly greater than a dollar-for-dollar relationship between growth (of assets) and internal finance, while firms that have the possibilities of acceding to significant amounts of external finance present a much weaker relationship between growth and internal finance (Carpenter and Petersen, 2002).

Cooper et al. (1994) also share some insights on the benefits of new ventures having access to financial resources at early stages of development. They show that the amount of initial capital is related to higher probabilities of survival and growth in new ventures. According to the authors, a higher amount of funds would provide advantages such as the abilities to buy time, undertake ambitious projects, afford high-quality

training for managers, which, ultimately, would lead the venture towards better growth prospects.

Finally, according to Shane and Stuart (2002), start-ups that receive venture capital funding have more chances of undergoing an IPO and conclude that social capital endowments facilitate external funding and have long-term positive effects on the performance of new companies. Balboa et al. (2011) also show that the funding provided by VCEs has a positive and significant impact on the growth and performance of invested firms, mainly in companies at early stages of development.

2.3. The non-financial value added provided by VCEs

VCEs take not only a fundamental role in the financing of SMEs, but they also provide value added services in the form of experience, management advice, access to the network of contacts, coaching, and mentoring (Croce et al., 2013; Sørensen, 2007a). Normally, value added comes in the form of periodic visits of investors to invested firms, reducing agency costs through monitoring; VCEs managers also help in defining strategic planning, management recruitment, and provide investee firms with an important network of financial and operational contacts (Sørensen, 2007b).

Compared to screening, value added services seem to be the main agent to impact the performance of portfolio companies (Croce et al., 2013). There is a broad variety of studies concerning the role of value added on performance. Macmillan et al. (1989) applied a questionnaire in which 350 VCEs ranked the activity of serving as a sounding board for the entrepreneurs, i.e. serving as an advice-giving team regarding new ideas and projects, as being one of the activities that required the most involvement by them as professionals. Hellmann and Puri (2002) find that investors have an impact on the internal process of professionalization of the invested firms. VC-backed firms make greater use of business and professional contacts when recruiting personnel and are more likely to appoint an external CEO (Hellmann and Puri, 2002).

Croce et al. (2013, p. 503) find that "productivity growth is substantially higher in VC-backed firms than in matched non-VC-backed ones after the first VC round", suggesting an important impact of value added services provided by VC managers on productivity during the holding period. Additionally, Chemmanur et al. (2011) show that the efficiency (total factor productivity) growth is greater for VC-backed companies than

for non-VC-backed ones. They argue that is due to the value added services provided by VCEs after the initial investment. Sapienza (1992) found that VCE's involvement in the invested firms is positively related to their performance.

Furthermore, the mentoring and coaching of invested firms by VCEs during the holding period may leave a long-lasting effect on the organization and operations of invested firms called the "imprinting" effect. The idea behind this is that the advice from VCE lingers further in time because of the upkeep of routines established during the holding period. This way, the value added is something that persists over time, even after the exit of VC investors. According to Croce et al. (2013, p. 493), "once the impact of VCs' involvement (which moves the portfolio firm's productivity towards higher levels than before VCs' entry) is absorbed, portfolio firms do not decrease their performance (i.e. productivity growth)". In addition, Davila et al. (2003) mention a "reputation effect" that comes along with the funding event; being selected by a VCE would transmit a positive signal about the quality of a new venture, reducing the uncertainty of being associated with it. This aspect may be important when reaching others for additional external financing, i.e., it might be important in relieving the financial restrictions SMEs face. This good reputation might play an important role in other aspects, like attracting skilled managers and workers and enabling managers to undertake projects under a less uncertain environment.

Some factors may affect the extent to which the VCEs can provide value added to the invested firms. It does not depend only on VCEs managers' willingness to provide value, but also on the desire of invested firm's managers to receive it. According to Sapienza et al. (1996), value added is greater in contexts of high uncertainty. The logic behind this stands in that the greater the uncertainty, the more willing the managers of invested firms will be to improve their decision-making process. Thereby, this implies that enterprises at early stages facing high levels of uncertainty are the ones that benefit more from value added services. Another factor that may affect VCEs value added is the experience of venture managers, whether in venture capital or focal industry. It makes sense to imagine that the more experienced they are, the better they will advise. Moreover, invested firms would be more open to accepting advice coming from more experienced managers who have a better understanding of venture capital or its focal

industry dynamics. They found that "operating experience in the venture's focal industry added significantly more value than those with less industry-specific experience" (Sapienza et al., 1996, p. 440). Concerning experience in the venture capital industry, Sapienza et al., (1996) findings suggest mixed evidence to support that. Berglund et al. (2007) show that VCE's general and industry-specific expertise is crucial in the experimentation and learning processes of new ventures.

2.4. Geographical distance and non-financial value added

An additional factor that may affect VCEs' value added may be the geographic distance between the investor and the invested firm. According to Sorenson and Stuart (2001), spatial proximity between the VCEs and invested firms facilitates the exchange of information, and thus the execution of the post-investment roles of the first, i.e. monitoring and other value-adding activities. Higher distances, which imply higher costs both from a financial and human resources perspective, might decrease the value added provided by VCEs, bringing negative effects to investees and thus resulting in worse performance. The time spent traveling reduces the number of companies that an individual can monitor (Sorenson and Stuart, 2001). In addition, Sapienza (1992) finds that the greater the frequency of interaction between VCEs and the CEOs of the invested ventures, the greater is the value of involvement of VCEs.

As supported by the empirical evidence illustrated in this section, the value added services provided by VCE managers have a major impact on the performance of invested firms. This non-financial support contributes to productivity growth, innovation, and the success of VCEs' portfolio companies. Since geographical distance may reduce the VCEs' ability to conduct a proper monitoring process and to provide other value-adding services, we argue that distant investee firms should show lower performance compared to that of those that are closer to the premises of the VCE. Hence, the first hypothesis is as follows:

H1: Distance and travel time between invested firms and VCEs negatively affect the performance of investee firms.

Furthermore, as commented in the first section, probably due to the broader independence when performing their activities, private VCEs seem to have the capacity to better monitor their portfolio companies, providing higher value-adding services

(Croce et al., 2019). Private VCEs also differ in the contractual organization, facing higher restrictions and pressure by their funders (limited partners), which require minimal financial returns (Alperovych et al., 2014). Bottazzi et al. (2008) show that private VCEs show higher levels of activism when compared to government-owned firms, i.e. private VCEs are more involved with their portfolio companies, hence adding more value. Conversely, the impact of government-managed VCEs on their investee firms is negligible (Grilli and Murtinu, 2014). Therefore, the second hypothesis to be tested is as follows:

> H2: D*istance and travel time between invested firms and VCEs are negatively related to firm performance for companies invested by private VCEs.*

3. DATA AND METHODOLOGY

3.1. Sample

The sample used in this essay consists of 1035 firms that received their initial venture capital round in Spain, dispersed across its seventeen regions, between 2005 and 2012. Data were extracted from three sources: Webcapitalriesgo, for information related to investee firms; ORBIS, for the financial and accounting data of these investee firms; and Google Maps, for data collection concerning distances and travel time between invested company and its respective VCE. Most firms are located in the communities of Andalucía, Cataluña, Madrid, and País Vasco. Concerning the current situation of analyzed firms, 687 (66%) are active, whilst the rest are inactive due to several reasons, like acquisition, dissolution, extinction, or liquidation.

In this work, the distance between invested companies and their respective (leading) VCE is computed in two ways: in kilometers and in time using the most effective transportation systems (car, bus, train or airplane) available. Presumably, the more time spent in transportation, the higher are the costs of providing qualitative support to invested companies, namely, monitoring. The distances and travel time were calculated using Google Maps. The process was carried out taking into account possible abnormalities that could affect the consistency of data collection. The time of displacement to airports was also considered. Care was taken to disregard holidays and rush hours in the collection process.

The sample consisted of firms funded by both government-managed and private VCEs. In order to test our hypotheses, the sample was grouped into four categories, according to the distance and travel time between the investee firms and their respective (leading) VCE: 1) companies that are located within the first quartile of distance of the sample and the ones that belong to the fourth; 2) companies that are located within the first quartile of travel time of the sample and the ones that belong to the fourth; 3) companies that are located within the second quartile of distance of the sample and the ones that belong to the fourth; 4) companies that are located within the second quartile of travel time of the sample and the ones that belong to the fourth. The idea behind this choice was to compare the closer and the more distant ones to verify the effects of distance and travel time on performance. The distribution between regions and investor type is as in Table 1 (first and fourth quartile) and Table 2 (second and fourth quartile). In general, companies that were invested by public or government-sponsored VCEs prevail among regions, except for Madrid, Cataluña, and Comunidad Valenciana, where private VCEs seem to lead the venture capital investment.

Regarding data collection of distance on Google Maps, the fastest route was always considered. The travel time was calculated doing the arithmetic average of the higher and the lower travel time estimated by Google Maps. Regarding public transportation, priority was given to train and underground. Regarding flight time, when available, priority was given to direct connections between airports, and the travel time (by car) spent from the airport to the premises of the investee firm was also computed and added to estimate the total travel time.

Table 1. Sample distribution of investee firms according to region and type of investor

	Firms first and fourth quartile (kilometers)					Firms first and fourth quartile (minutes)				
Region	Public investors	%	Private investors	%	**Total sample**	Public investors	%	Private investors	%	**Total sample**
Andalucia	90	89.1%	11	10.9%	**101**	134	94.4%	8	5.6%	**142**
Aragon	19	79.2%	5	20.8%	**24**	16	76.2%	5	23.8%	**21**
Asturias	19	95.0%	1	5.0%	**20**	23	95.8%	1	4.2%	**24**
Baleares		0.0%	7	100.0%	**7**					**0**
Canarias		0.0%	2	100.0%	**2**		0.0%	2	100.0%	**2**
Cantabria	2	66.7%	1	33.3%	**3**	2	50.0%	2	50.0%	**4**
Castilla La Mancha	5	62.5%	3	37.5%	**8**	9	75.0%	3	25.0%	**12**
Castilla Leon		0.0%	4	100.0%	**4**	7	46.7%	8	53.3%	**15**
Cataluña	30	19.9%	121	80.1%	**151**	21	20.0%	84	80.0%	**105**
Comunidad Valenciana	4	11.8%	30	88.2%	**34**	3	14.3%	18	85.7%	**21**
Extremadura	13	92.9%	1	7.1%	**14**	14	93.3%	1	6.7%	**15**
Galicia	8	80.0%	2	20.0%	**10**	7	77.8%	2	22.2%	**9**
La Rioja	2	100.0%		0.0%	**2**	2	100.0%		0.0%	**2**
Madrid	18	18.8%	78	81.3%	**96**	14	16.1%	73	83.9%	**87**
Murcia	1	50.0%	1	50.0%	**2**	3	75.0%	1	25.0%	**4**
Navarra	21	72.4%	8	27.6%	**29**	25	80.6%	6	19.4%	**31**
Pais Vasco	18	69.2%	8	30.8%	**26**	22	84.6%	4	15.4%	**26**
Total	**250**	**46.9%**	**283**	**53.1%**	**533**	**302**	**58.1%**	**218**	**41.9%**	**520**

Sample distribution of investee firms according to region and type of investor for each sample category, first and fourth quartiles. For each category, we have the distribution among public and private investors by regions and for the total sample.

Table 2. Sample distribution of distances to investee firms according to region and type of investor

	Firms second and fourth quartile (kilometers)					Firms second and fourth quartile (minutes)				
Region	Public investors	%	Private investors	%	**Total sample**	Public investors	%	Private investors	%	**Total sample**
Andalucia	134	91.8%	12	8.2%	**146**	167	94.9%	9	5.1%	**176**
Aragon	29	82.9%	6	17.1%	**35**	31	83.8%	6	16.2%	**37**
Asturias	45	97.8%	1	2.2%	**46**	45	97.8%	1	2.2%	**46**
Baleares		0.0%	7	100.0%	**7**					**0**
Canarias		0.0%	2	100.0%	**2**		0.0%	2	100.0%	**2**
Cantabria	2	50.0%	2	50.0%	**4**	2	50.0%	2	50.0%	**4**
Castilla La Mancha	5	62.5%	3	37.5%	**8**	9	75.0%	3	25.0%	**12**
Castilla Leon	5	55.6%	4	44.4%	**9**	11	57.9%	8	42.1%	**19**
Cataluña	42	19.6%	172	80.4%	**214**	38	19.2%	160	80.8%	**198**
Comunidad Valenciana	4	9.8%	37	90.2%	**41**	3	10.7%	25	89.3%	**28**
Extremadura	15	93.8%	1	6.3%	**16**	17	94.4%	1	5.6%	**18**
Galicia	10	83.3%	2	16.7%	**12**	11	84.6%	2	15.4%	**13**
La Rioja	2	100.0%		0.0%	**2**	2	100.0%		0.0%	**2**
Madrid	33	25.2%	98	74.8%	**131**	27	22.1%	95	77.9%	**122**
Murcia	3	75.0%	1	25.0%	**4**	3	75.0%	1	25.0%	**4**
Navarra	29	76.3%	9	23.7%	**38**	29	80.6%	7	19.4%	**36**
Pais Vasco	54	87.1%	8	12.9%	**62**	56	93.3%	4	6.7%	**60**
Total	**412**	**53.0%**	**365**	**47.0%**	**777**	**451**	**58.0%**	**326**	**42.0%**	**777**

Sample distribution of investee firms according to region and type of investor for each sample category, second and fourth quartiles. For each category, we have the distribution among public and private investors by regions and for the total sample.

3.2. Empirical strategy and methodology

Our empirical approach is to compare the performance of distant versus close investee firms using a DD methodology with fixed effects. In order to do the comparison and to observe the average effect of distance and travel time on the dependent variables, the sample was divided into four groups: firms that are further away and firms that are closer, both in the pre-investment and the post-investment period. The main model is as follows:

$$Y_{i,t} = \alpha_0 + \alpha_1 VCinv_{i,t} + \alpha_2 Quartile_i + \alpha_3 VCinv_{i,t} Quartile_i + \eta_i + \varepsilon_{i,t}$$

The dependent variables are the logarithm plus 1 of gross revenues (*lnGrossRevenues*) and total assets (*lnAssets*) of investee firms, as a representation of performance.

The independent variables are:

- *VCinv*, a dummy variable defining the event of the venture capital investment, equal to 0 during the pre-investment period and to 1 during the post-investment period for each observation.
- *Quartile*, an unchanging dummy variable defining the distance or time quartile that corresponds to each investee firm, according to the distance and travel time taken from its respective VCE. As noted above, in order to test the hypotheses, the sample was divided into four groups, hence this variable takes a slightly different interpretation for each regression model. In *Model 1* and *Model 2*, this variable is equal to 1 if the firm belongs to the first quartile of distance or travel time, and is equal to 0 if it belongs to the fourth; in *Model 3* and *Model 4*, this variable is equal to 1 if the firm belongs to the second quartile of distance or travel time and is equal to 0 if it belongs to the fourth.

The results of a Hausman test indicated that the best estimation procedure would be with fixed effects. Since the variable Quartile is unchangeable for each individual over time, its coefficient is not estimated in all specifications.

The coefficient of the interaction term *VCinvQuartile* is the DD estimator of our models, and measures the average effect on the dependent variables of the distance or travel time of a firm with respect to its VCE.

In addition, the model also includes several control variables (η_i). *RegionVC* is a dummy variable equal to 1 if the firm is located in Madrid or Cataluña (i.e., venture capital cluster regions), or zero otherwise. *AgeComp* it is the age of the company at the time of each observation. *Private* is a dummy variable equal to 1 if the company is invested by a private VCE, or zero otherwise. *LnKm* and *LnMin* represent the logarithm of the distance in kilometers and the travel time in minutes, respectively, from the lead VCE's headquarters to the investee's premises. Sector and year dummies are also considered.

We build four specifications for each dependent variable to test our hypotheses. *Model 1*, which compares firms located within the first quartile of distance from the VCE with the ones that belong to the fourth. *Model 2*, which compares firms located within the first quartile of travel time taken to reach the VCE with the ones that belong to the fourth. *Model 3*, which compares firms located within the second quartile of distance from the VCE with the ones that belong to the fourth. *Model 4*, which compares firms located within the second quartile of travel time taken to reach the VCE with the ones that belong to the fourth.

3.3.Descriptive statistics

In Table 3 and Table 4, we show the average values for our dependent variables for the whole sample (including firms that received funding from public VCEs) and only for firms that received funding from private VCEs, respectively. The average values are calculated, for comparative purposes, for the year before the VC funding (-1) and two years after this event (2). In each table, we can see the results for each subcategory, according to the quartile they belong to, and the percentage changes between the analyzed periods for the investees that are more distant and for those that are closer to the lead VCE. In all cases, the average values showed growth after the funding event, both for gross revenues and assets. However, it is interesting to observe that, for firms funded by private VCEs, growth was significantly higher for those that were closer to the VCE's premises when compared to the distant ones (Table 4), contrary to the overall results for the whole sample. This might suggest that private VCEs are capable of providing higher value added services (Croce et al., 2019), as discussed in section 2.

In addition, the short distance/time of first quartile investee firms justifies the consideration of the second quartile as "close" firms. Regarding distance, the first and second quartiles go up to 6 and 33 kilometers, respectively, with an arithmetic average of 177 kilometers. Regarding time, the first and second quartiles go up to 16 and 37 minutes, respectively, with an arithmetic average of 71 minutes.

Table 3. Average values for all firms one year before VC investment and two years after

	Average lnGrossRevenues				Average lnAssets			
All firms								
Year since VC investment	**First and fourth quartile (min)**							
	Fourth quartile	% Growth	First quartile	% Growth	Fourth quartile	% Growth	First quartile	% Growth
-1	4.9122		4.8298		7.0323		6.3803	
2	11.6176	136.5%	10.9246	126.2%	13.8463	96.9%	13.3104	108.6%
	First and fourth quartile (km)							
	Fourth quartile	% Growth	First quartile	% Growth	Fourth quartile	% Growth	First quartile	% Growth
-1	5.5855		5.2667		7.5564		6.8411	
2	11.8744	112.6%	11.1174	111.1%	13.964	84.8%	13.4587	96.7%
	Second and fourth quartile (min)							
	Fourth quartile	% Growth	Second quartile	% Growth	Fourth quartile	% Growth	Second quartile	% Growth
-1	4.9121		5.5039		7.0323		7.1542	
2	11.6176	136.5%	11.6791	112.2%	13.8463	96.9%	13.721	91.8%
	Second and fourth quartile (km)							
	Fourth quartile	% Growth	Second quartile	% Growth	Fourth quartile	% Growth	Second quartile	% Growth
-1	5.5855		5.5232		7.5564		7.1738	
2	11.8744	112.6%	11.6564	111.0%	13.964	84.8%	13.7079	91.1%

Average values for dependent variables *lnGrossRevenues* and *lnAssets* for all firms for the years -1 and 2 since the venture capital funding event. The results are clustered by quartiles. There is a column for each case showing the percentage growth between years -1 (before VC investment) and 2, two years after investment.

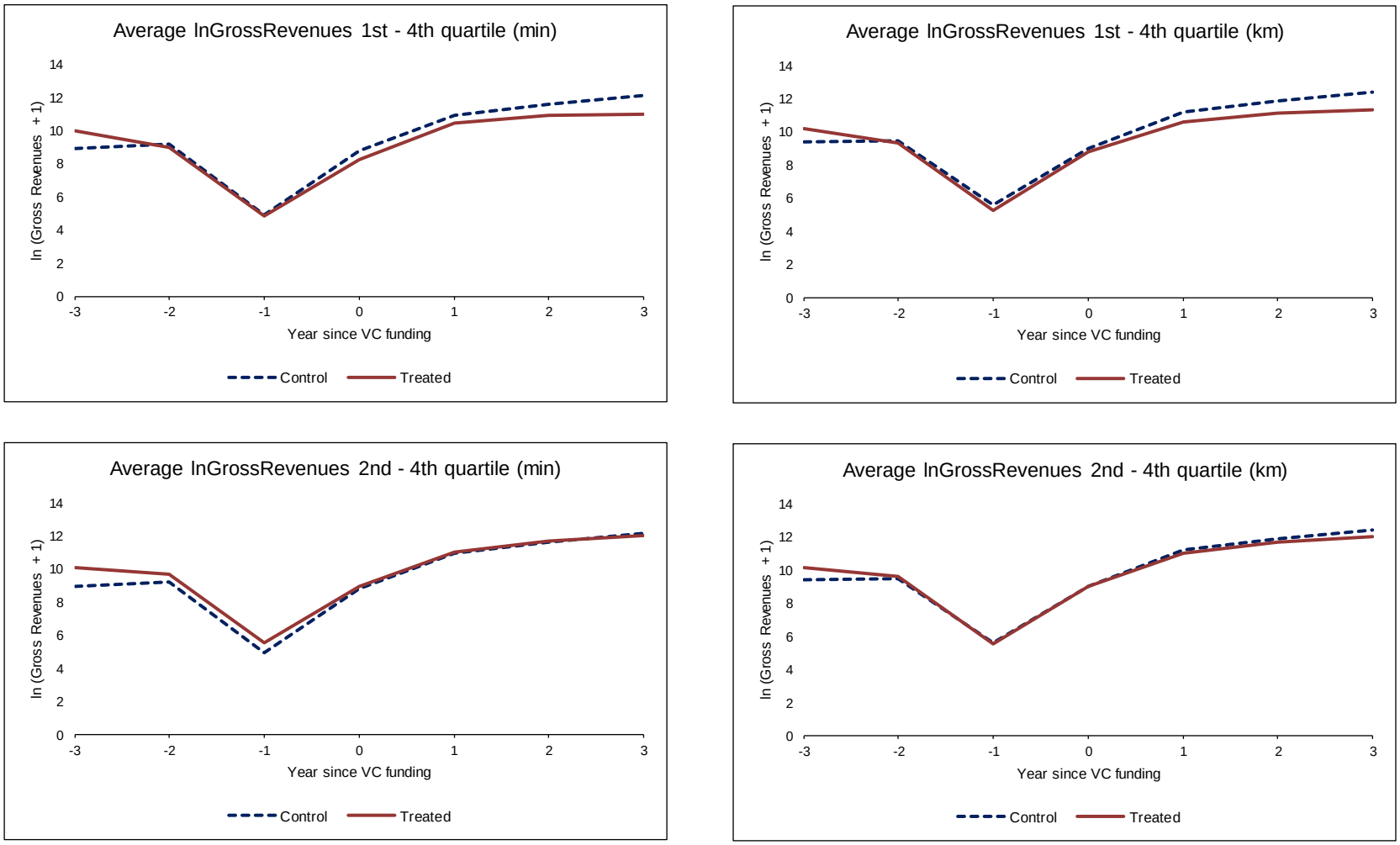
Table 4. Average values for private invested firms one year before VC investment and two years after

	Average lnGrossRevenues				Average lnAssets			
	Private firms							
Year since VC investment	**First and fourth quartile (min)**							
	Fourth quartile	% Growth	First quartile	% Growth	Fourth quartile	% Growth	First quartile	% Growth
-1	6.5286		4.5749		8.5404		6.5816	
2	12.0736	84.9%	10.7354	134.7%	14.3173	67.6%	13.5953	106.6%
	First and fourth quartile (km)							
	Fourth quartile	% Growth	First quartile	% Growth	Fourth quartile	% Growth	First quartile	% Growth
-1	6.6007		5.286		8.4586		7.1901	
2	12.2805	86.0%	11.0906	109.8%	14.3391	69.5%	13.6921	90.4%
	Second and fourth quartile (min)							
	Fourth quartile	% Growth	Second quartile	% Growth	Fourth quartile	% Growth	Second quartile	% Growth
-1	6.5286		5.3891		8.5404		7.1141	
2	12.0736	84.9%	11.5488	114.3%	14.3173	67.6%	13.8514	94.7%
	Second and fourth quartile (km)							
	Fourth quartile	% Growth	Second quartile	% Growth	Fourth quartile	% Growth	Second quartile	% Growth
-1	6.6007		5.411		8.4586		7.1291	
2	12.2805	86.0%	11.5453	113.4%	14.3391	69.5%	13.8454	94.2%

Average values for dependent variables *lnGrossRevenues* and *lnAssets* only for firms invested by private VCEs for the years -1 and 2 since the venture capital funding event. The results are clustered by quartiles. There is a column for each case showing the percentage growth between years -1 (before VC investment) and 2, two years after investment.

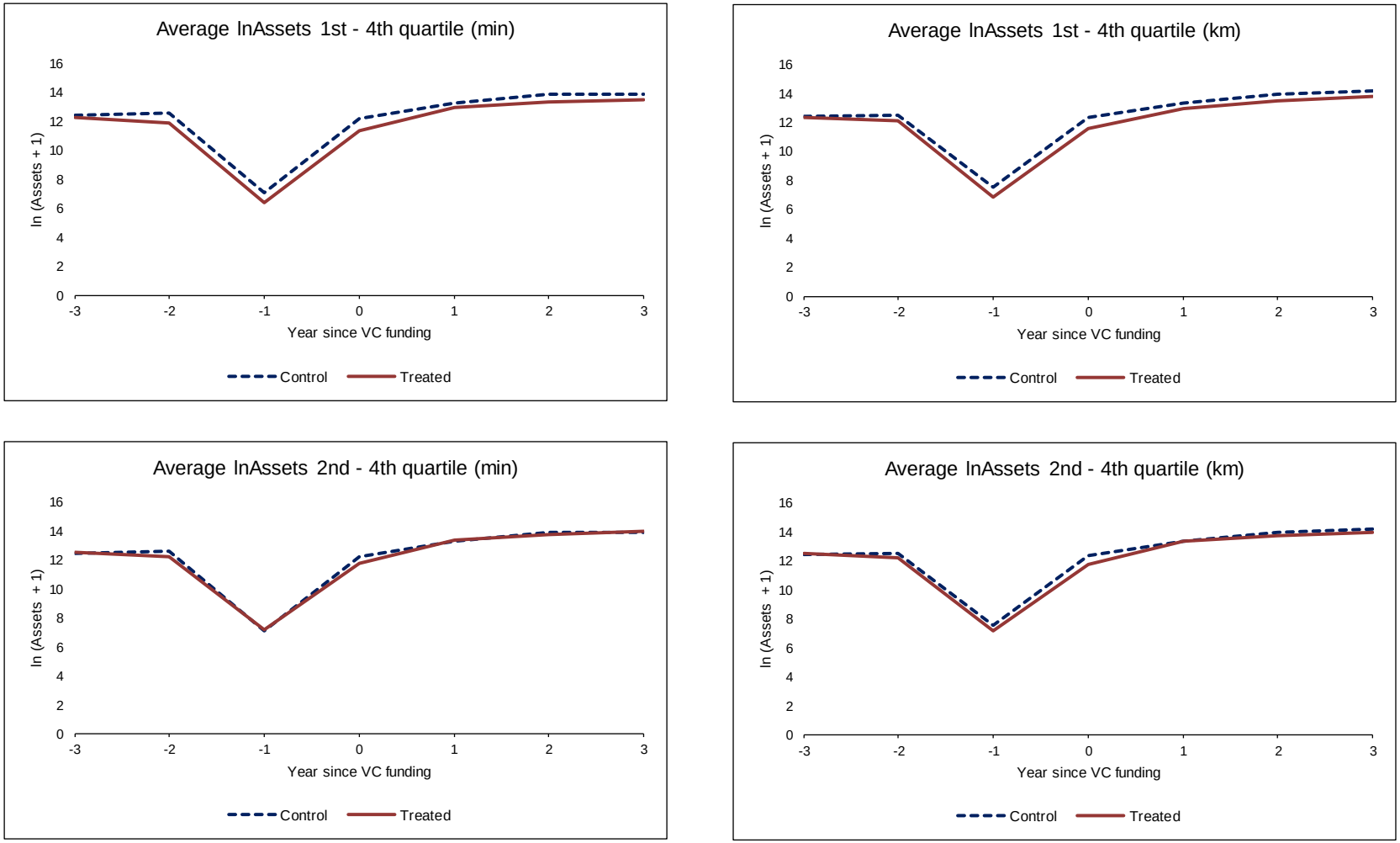
A crucial aspect of the difference-in-differences (DD) methodology is the parallel trend assumption (Roberts and Whited, 2013; Wing et al., 2018). According to this assumption, the distant and closer firms (to the lead VCE) should show, on average, a similar trend before the treatment, i.e., the VC funding. The treated group consists of the closer firms receiving VC funding, while the control group consists of the distant firms receiving VC funding. In order to verify if this assumption is satisfied, we proceeded with a graphical analysis. In Figures 1 and 2, we have a graphical representation of the average values for the dependent variables for the 3 years before the VC funding through the 3 years after this event, for closer and distant firms and the four categories of our sample. Since both the control and treated groups show a similar trend before the VC funding, the parallel trends assumption seems to be fulfilled.

Figure 1. Evolution of the average values for *lnGrossRevenues* before and after VC funding



Graphs show a parallel trend of *lnGrossRevenues* between control (most distant firms) and treated group (closest firms). The dotted line represents the control group. Above each chart, we can see which sample it refers to. On the vertical axis, we have the average value for *lnGrossRevenues*. On the horizontal axis, we have the years since venture capital funding; year 0 represents the moment when the venture capital investment occurred.

Figure 2. Evolution of the average values for *lnAssets* before and after VC funding



Graphs show a parallel trend of *lnAssets* between control (most distant firms) and treated group (closest firms). The dotted line represents the control group. Above each chart we can see which sample it refers to. On the vertical axis, we have the average value for *lnAssets*. On the horizontal axis, we have the years since venture capital funding; year 0 represents the moment when the venture capital investment occurred.

4. RESULTS

In Table 5, we show the results of the regression on the dependent variable *lnGrossRevenues,* displayed across two panels: first versus fourth quartile in kilometers and in minutes (Panel A), and second versus fourth quartile in kilometers and minutes (Panel B). In Table 6 we present the same in Panel C and Panel D, respectively, but for the dependent variable *lnAssets.*

For all scenarios and dependent variables, the coefficient of *VCinv* is significant (p-value<1%) and positive, confirming that in fact VC funding has an important impact on the performance of investee firms. In the next paragraphs, the results of our DD estimator are outlined, confirming or rejecting our hypotheses.

Regarding our first hypothesis (H1), i.e., that distance and travel time between invested firms and VCEs negatively affect the performance of investee firms, for all firms, the distance in kilometers is not significant for any model specification. As regards the distance in minutes, also the results of the interaction variable shown in column 3 of panels C and D in Table 6 (Log Assets) do not show any significant coefficient. However, the same coefficients in table 5 (Gross revenues) show significant, but negative coefficients, indicating that the most distant firms show better performance than the ones that are closer to the VCE's premises. In particular, the coefficient for the interaction variable is -0.6170 (p-value<5%, Panel A, column 3), meaning that companies belonging to the fourth quartile in minutes grow significantly more in gross revenues than those belonging to the first quartile. Panel B (column 3) shows a similar negative value (-0.7466, p-value<5%) when gross revenues of second and fourth quartile companies are compared. Therefore, for the whole sample (including both public and private VCEs), our results do not corroborate H1.

Nevertheless, since the quality and quantity of value added provided by public VCEs is discussed in the literature (Alperovych et al., 2015; Bottazzi et al., 2008; Croce et al., 2019; Grilli and Murtinu, 2014), we considered that the weight of public invested firms in the sample might be influencing our results. Hence, in the second and fourth columns of each panel, we have the results solely for the firms invested by private VCEs. For the dependent variable *lnGrossRevenues*, we do not have significant results.

However, we have significant and positive coefficients for *lnAssets* (Panels C and D), both for distance in kilometers and minutes, providing partial support for our second hypothesis (H2), i.e., distance and travel time between invested firms and VCEs are negatively related to firm performance for companies invested by private VCEs. For the first versus fourth quartile in minutes (Panel C, column four, coefficient 1.1782), we have that, for companies that received funds from private VCEs, the assets growth of the closest ones is 224,85%[1] higher when compared to the most distant ones (p-value<5%). When comparing the second quartile with the fourth, both in kilometers and minutes (Panel D, columns two and four, coefficients 0.8279 and 0.8523), the closest exceeded the most distant ones in around 130% in terms of assets growth (p-value<5%).

[1] Transformation: $(e^{coefficient} - 1) * 100 = (e^{1.1782} - 1) * 100$

Table 5. Regressions results on *lnGrossRevenues*

Dependent variable *lnGrossRevenues*

Panel A

	First and fourth quartile (km)		First and fourth quartile (min)	
Independent variables	All firms	Private investors	All firms	Private investors
VCinv	3.9562 (0.2902) ***	3.7243 (0.3617) ***	4.2881 (0.3062) ***	3.7208 (0.4363) ***
VCinvQuartile	-0.3767 (0.3405)	-0.1096 (0.4307)	-0.6170 (0.3635) *	0.3079 (0.5299)
RegionVC	-2.2585 (0.9984) **	0.3147 (0.6467)	-1.0444 (1.1555)	-1.5597 (0.5785) ***
AgeComp	-0.0089 (0.0062)	-0.0083 (0.0079)	-0.0095 (0.0062)	-0.01227 (0.0085)
Sector dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
const	11.2481 (1.1915) ***	14.7968 (2.7554) ***	10.3118 (1.8474) ***	11.0508 (0.7310) ***
Obs.	4563	2498	4308	1818
R^2	0.6081	0.639	0.598	0.6308

Dependent variable *lnGrossRevenues*

Panel B

	Second and fourth quartile (km)		Second and fourth quartile (min)	
Independent variables	All firms	Private investors	All firms	Private investors
VCinv	3.9908 (0.2781) ***	3.6981 (0.3476) ***	4.3793 (0.2920) ***	3.8746 (0.4082) ***
VCinvQuartile	-0.3750 (0.3062)	0.2458 (0.3929)	-0.7466 (0.3196) **	0.0897 (0.4489)
RegionVC	-2.2132 (0.9962) **	-0.3023 (0.6614)	-0.7708 (1.0625)	-0.8645 (0.7818)
AgeComp	0.0132 (0.0118)	-0.009 (0.008)	0.0136 (0.0118)	-0.0105 (0.0081)
Sector dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
const	11.7692 (2.1790) ***	14.8363 (2.7793) ***	10.5925 (1.9182) ***	10.8447 (0.7842) ***
Obs.	6764	3156	6655	2741
R^2	0.5921	0.6434	0.598	0.6483

The table shows the fixed effects results for the dependent variable *lnGrossRevenues*. The independent variables are: (1) VCinv: Dummy variable that takes value 1 from the year of the initial VC investment on, and zero otherwise. (2) Quartile: Dummy variable that takes value 1 for firms belonging to the 1-2 quartile of distance, depending on the specification, or zero otherwise. The model also includes control variables: Age, Cluster VC regions, plus sector and year dummies. In Panel A, we show the results for the sample comparing first versus fourth quartile in kilometers and minutes, whereas in Panel B we show the results for the sample comparing second versus fourth quartile firms in kilometers and minutes. There are two columns for each comparison: all firms, showing the results for all sample firms, and private investors, showing results only for firms invested by private VCEs. The first column shows the independent variables of the model; in each respective line we have the coefficients and, in parenthesis, the standard errors for each variable. In the last two lines of each panel we can see the number of observations of each regression model and the coefficient of determination, R squared. Sector and year dummies are included. Level of significance: * p-value<10%, ** p-value<5%, *** p-value<1%.

Table 6. Regressions results on *lnAssets*

	Dependent variable *lnAssets*			
	Panel C			
	First and fourth quartile (km)		First and fourth quartile (min)	
Independent variables	All firms	Private investors	All firms	Private investors
VCinv	3.9922 (0.2723) ***	3.6418 (0.3437) ***	4.2050 (0.2957) ***	3.5326 (0.4212) ***
VCinvQuartile	0.3147 (0.3261)	0.5936 (0.4092)	0.3360 (0.3523)	1.1782 (0.5092) **
RegionVC	-0.8516 (0.4209) **	-0.1049 (0.6198)	-0.7970 (0.5415)	-1.4308 (0.5085) ***
AgeComp	-0.0108 (0.0082)	-0.0026 (0.0056)	-0.01219 (0.0086)	-0.0041 (0.0066)
Sector dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
const	12.4382 (0.9469) ***	15.8402 (2.4964) ***	11.1991 (1.0146) ***	12.3044 (0.5332) ***
Obs.	4563	2498	4304	1818
R^2	0.5969	0.5945	0.5939	0.5883

	Dependent variable *lnAssets*			
	Panel D			
	Second and fourth quartile (km)		Second and fourth quartile (min)	
Independent variables	All firms	Private investors	All firms	Private investors
VCinv	4.0802 (0.2605) ***	3.6367 (0.3320) ***	4.3868 (0.2812) ***	3.5815 (0.3967) ***
VCinvQuartile	0.0770 (0.2894)	0.8279 (0.3733) **	-0.2146 (0.3079)	0.8523 (0.4327) **
RegionVC	-0.8105 (0.4177) *	-0.0781 (0.6357)	-0.4666 (0.5412)	-0.5846 (0.8169)
AgeComp	0.0026 (0.0082)	-0.0028 (0.0058)	0.0029 (0.0082)	-0.0029 (0.0060)
Sector dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
const	11.3371 (1.0845) ***	15.7480 (2.5097) ***	10.8267 (0.9696) ***	11.6890 (0.7342) ***
Obs.	6764	3156	6651	2741
R^2	0.5888	0.5983	0.5872	0.5925

The table shows the fixed effects results for the dependent variable *lnAssets*. The independent variables are: (1) VCinv: Dummy variable that takes value 1 from the year of the initial VC investment on, and zero otherwise. (2) Quartile: Dummy variable that takes value 1 for firms belonging to the 1-2 quartile of distance, depending on the specification, or zero otherwise. The model also includes control variables: Age, Cluster VC regions, plus sector and year dummies. In Panel C, we show the results for the sample comparing first versus fourth quartile in kilometers and minutes, whereas in Panel D we show the results for the sample comparing second versus fourth quartile firms in kilometers and minutes. There are two columns for each comparison: all firms, showing the results for all sample firms, and private investors, showing results only for firms invested by private VCEs. The first column shows the independent variables of the model; in each respective line we have the coefficients and, in parenthesis, the standard errors for each variable. In the last two lines of each panel we can see the number of observations of each regression model and the coefficient of determination, R squared. Sector and year dummies are included. Level of significance: * p-value<10%, ** p-value<5%, *** p-value<1%.

5. DISCUSSION AND CONCLUSION

VCEs play an important role in enhancing the success prospects and performance of SMEs. They offer both financial aid, in the form of capital provision, and qualitative aid, in the form of value-adding services. Considering this qualitative aid depends on face-to-face interactions, geographical distance between investees and their lead VCE might impose costs in providing these services. The purpose of this work is to verify whether the distance, measured both in kilometers and in minutes (travel time), had a significant impact on the performance of the invested firms.

Our results support the importance of venture capital funding on the performance of SMEs. Regarding our hypotheses, the results do not corroborate our first hypothesis (H1), i.e., that distance and travel time between invested firms and VCEs negatively affect the performance of investee firms.

A first explanation for these results might be that, when investing in more distant firms, VCEs target mature firms more often than early-stage ones. These ventures normally possess more track records, which ease the execution of a quality assessment by the VCE. They also require less intensive monitoring, as they are more consolidated companies. In addition to that, VCEs that invest in ventures that are more distant use to be the more experienced ones, and can provide more qualified value-adding services at a lower cost (Sapienza et al., 1996; Sorenson and Stuart, 2001). Another possible explanation is syndication, which is a form of overcoming the difficulties created by geographic distance on adding value (Fritsch and Schilder, 2012). For all the factors exposed above, our models might not have captured the real effect of distance and travel time on the provision of value added services by VCEs and on performance under normal circumstances.

However, since the quality and quantity of value added provided by public VCEs are debated in the literature, our results are certainly affected by the significant weight of firms backed by government-managed VCEs in our sample. When we focus on ventures funded by private VCEs, we do not find significant differences in sales between closer and distant ventures, but we do find significant differences in total assets growth, thus providing partial support to our H2. In particular, when comparing the second quartile

with the fourth, both in kilometers and minutes, the closest firms showed a superior assets growth around the 130% when compared with the most distant ones (significant at the 5% level).

Further investigation should be carried out in order to clarify the influence of the factors mentioned above on our sample and our results. We should start by investigating whether the screening process was more meticulous for distant firms. We also should verify whether the more distant ventures were in fact more consolidated companies, and hence required less value added services efforts. Besides, the VCE's experience and syndication agreements should be studied, in order to establish their conditions of providing value added services.

REFERENCES

Akerlof, G.A., 1970. The market for “lemons”: Quality uncertainty and the market mechanism. Q. J. Econ. 84, 488–500. https://doi.org/10.2307/1879431

Alemany, L., Martí, J., 2007. Productivity growth in Spanish venture-backed firms. Ventur. Cap. Eur. 101–114. https://doi.org/10.1016/B978-075068259-6.50011-7

Alperovych, Y., Collongue, A.G. De, Hübner, G., 2014. How does Governmental vs . Private Venture Capital Backing Affect a Firm ’ s Efficiency ? Evidence from Belgium. Elsevier 32.

Alperovych, Y., Hübner, G., Lobet, F., 2015. How does governmental versus private venture capital backing affect a firm’s efficiency? Evidence from Belgium. J. Bus. Ventur. 30, 508–525. https://doi.org/10.1016/j.jbusvent.2014.11.001

Amit, R., Brander, J.A., Zott, C., 1998. Why do venture capital firms exist? theory and canadian evidence. J. Bus. Ventur. 13, 441–466. https://doi.org/10.1016/S0883-9026(97)00061-X

Balboa, M., Martí, J., Zieling, N., 2011. Impact of funding and value added on Spanish venture capital-backed firms. Innovation 24, 449–466. https://doi.org/10.1080/13511610.2011.628827

Belke, A., Fehn, R., Foster, N., 2003. Does Venture Capital Investment Spur Employment Growth? CESifo Work. Pap. Ser.

Berglund, H., Hellström, T., Sjölander, S., 2007. Entrepreneurial learning and the role of venture capitalists. Ventur. Cap. 9, 165–181. https://doi.org/10.1080/13691060701324445

Bertoni, F., Colombo, M.G., Croce, A., 2010. The effect of venture capital financing on the sensitivity to cash flow of firm’s investments. Eur. Financ. Manag. 16, 528–551. https://doi.org/10.1111/j.1468-036X.2008.00463.x

Bertoni, F., Colombo, M.G., Grilli, L., 2011. Venture capital financing and the growth of high-tech start-ups: Disentangling treatment from selection effects. Res. Policy 40, 1028–1043. https://doi.org/10.1016/j.respol.2011.03.008

Bertoni, F., Ferrer, M.A., Martí, J., 2013. The different roles played by venture capital and private equity investors on the investment activity of their portfolio firms.

Small Bus. Econ. 40, 607–633. https://doi.org/10.1007/s11187-011-9384-x

Bottazzi, L., Da Rin, M., Hellmann, T., 2008. Who are the active investors?. Evidence from venture capital. J. financ. econ. 89, 488–512. https://doi.org/10.1016/j.jfineco.2007.09.003

Carpenter, R.E., Petersen, B.C., 2002. Is the Growth of Small Firms Constrained by Internal Finance? Rev. Econ. Stat. 84, 298–309. https://doi.org/10.1162/003465302317411541

Chemmanur, T.J., Krishnan, K., Nandy, D.K., 2011. How does venture capital financing improve efficiency in private firms? A look beneath the surface. Rev. Financ. Stud. 24, 4037–4090. https://doi.org/10.1093/rfs/hhr096

Cooper, A.C., Gimeno-Gascon, F.J., Woo, C.Y., 1994. Initial human and financial capital as predictors of new venture performance. J. Bus. Ventur. 9, 371–395. https://doi.org/10.1016/0883-9026(94)90013-2

Croce, A., Martí, J., Murtinu, S., 2013. The impact of venture capital on the productivity growth of European entrepreneurial firms: “Screening” or “value added” effect? J. Bus. Ventur. 28, 489–510. https://doi.org/10.1016/j.jbusvent.2012.06.001

Croce, A., Martí, J., Reverte, C., 2019. The role of private versus governmental venture capital in fostering job creation during the crisis. Small Bus. Econ. 53, 879–900. https://doi.org/10.1007/s11187-018-0108-3

Davila, A., Foster, G., Gupta, M., 2003. Venture capital financing and the growth of startup firms. J. Bus. Ventur. 18, 689–708. https://doi.org/10.1016/S0883-9026(02)00127-1

Fritsch, M., Schilder, D., 2012. The regional supply of venture capital: Can syndication overcome bottlenecks? Econ. Geogr. 88, 59–76. https://doi.org/10.1111/j.1944-8287.2011.01139.x

Grilli, L., Murtinu, S., 2014. Government, venture capital and the growth of European high-tech entrepreneurial firms. Res. Policy 43, 1523–1543. https://doi.org/10.1016/j.respol.2014.04.002

Hellmann, T., Puri, M., 2002. Venture capital and the professionalization of start-up firms: Empirical evidence. J. Finance 57, 169–197. https://doi.org/10.1111/1540-

6261.00419

Macmillan, I.C., Kulow, D.M., Khoylian, R., 1989. Venture capitalists' involvement in their investments: Extent and performance. J. Bus. Ventur. 4, 27–47. https://doi.org/10.1016/0883-9026(89)90032-3

Myers, S.C., Majluf, N.S., 1984. Corporate financing and investment decisions when firms have information that investors do not have. J. financ. econ. 13, 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

Roberts, M.R., Whited, T.M., 2013. Endogeneity in Empirical Corporate Finance, Handbook of the Economics of Finance. https://doi.org/10.1016/B978-0-44-453594-8.00007-0

Robu, M., 2013. the Dynamic and Importance of Smes in Economy. USV Ann. Econ. Public Adm. 13, 84–89.

Sapienza, H.J., 1992. When do venture capitalists add value? J. Bus. Ventur. 7, 9–27. https://doi.org/10.1016/0883-9026(92)90032-M

Sapienza, H.J., Manigart, S., Vermeir, W., 1996. Venture capitalist governance and value added in four countries. J. Bus. Ventur. 11, 439–469. https://doi.org/10.1016/S0883-9026(96)00052-3

Shane, S., Stuart, T., 2002. Organizational endowments and the performance of university start-ups, in: Management Science. pp. 154–170. https://doi.org/10.1287/mnsc.48.1.154.14280

Sørensen, M., 2007a. American Finance Association How Smart Is Smart Money? Source J. Financ. 62, 2725–2762.

Sørensen, M., 2007b. How Smart Is Smart Money? A Two-sided Matching Model of Venture Capital. J. Finance 62, 2725–2762. https://doi.org/10.1111/j.1540-6261.2007.01291.x

Sorenson, O., Stuart, T.E., 2001. Syndication networks and the spatial distribution of venture capital investments. Am. J. Sociol. 10, 1546–1588. https://doi.org/10.1086/321301

Stein, J.C., 2003. Chapter 2 Agency, information and corporate investment. Handb. Econ. Financ. 1, 111–165. https://doi.org/10.1016/S1574-0102(03)01006-9

Weiss, W.L.M.K.A., 1991. American Finance Association Venture Capitalist Certification in Initial Public Offerings Author (s): William L . Megginson and Kathleen A . Weiss Source : The Journal of Finance , Vol . 46 , No . 3 , Papers and Proceedings , Fiftieth Annual Meeting , A. J. Finance 46, 879–903.

Wing, C., Simon, K., Bello-Gomez, R.A., 2018. Designing Difference in Difference Studies: Best Practices for Public Health Policy Research. Annu. Rev. Public Health 39, 453–469. https://doi.org/10.1146/annurev-publhealth-040617-013507